IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Response Under 37 C.F.R. § 1.116 Expedited Procedure

In re application of:
Larry C. Olsen et al.
Application No. 10/726,744
Filed: December 2, 2003
Confirmation No. 6833
For: THERMOELECTRIC DEVICES AND APPLICATIONS FOR THE SAME
Examiner: Jeffrey Thomas Barton
Art Unit: 1795
Attorney Reference No. 23-65037-01

CERTIFICATE OF MAILING

I hereby certify that this paper and the documents referred to as being attached or enclosed herewith are being deposited with the United States Postal Service as First Class Mail in an envelope addressed to: MAIL STOP RCE, COMMISSIONER FOR PATENTS, P.O. BOX 1450, ALEXANDRIA, VA 22313-1450 on the date shown below.

Attorney or Agent for Applicant(s) _____

Date Mailed 5/20/08

MAIL STOP RCE
COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450

AMENDMENT AFTER FINAL ACTION

This responds to the Office action dated February 29, 2008. Please amend the referenced application as follows:

Amendments to the Claims are reflected in the listing of claims, which begins on page 2.

Remarks begin on page 6.

Claims

1. (Currently Amended) A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a plurality of thermoelectric couples with the thermoelectric couples comprising:

(a) a sputter deposited thin film p-type thermoelement positioned on the upper surface of the flexible substrate;

(b) a sputter deposited thin film n-type thermoelement positioned on the upper surface of the flexible substrate adjacent the p-type thermoelement; ~~and~~

(c) an electrically conductive member positioned on the flexible substrate, and electrically connecting the first end of the p-type thermoelement with the second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y wherein x is about 2 and y is about 3; and

wherein the thermoelectric couples are formed on a single substrate and the flexible substrate is in a coil configuration or an accordion configuration.

2. (Original) The thermoelectric power source of claim 1 wherein the p-type or the n-type thermoelements have L/A ratios greater than about 20 cm^{-1}.

3. (Original) The thermoelectric power source of claim 1 wherein the p-type or the n-type thermoelements have L/A ratios greater than about 100 cm^{-1}.

4. (Canceled)

5. (Currently Amended) The thermoelectric power source of claim 1 wherein the thermoelectric power source has a power output of at least about 1 μW with a voltage of at least about 0.25 volt ~~p-type or the n-type thermoelements comprise Bi_xTe_y, where x is about 2 and y is about 3~~.

6. (Previously presented) The thermoelectric power source of claim 1 further comprising at least about 50 thermoelectric couples, wherein the thermoelectric power source has a power output of at least about 1 μW with a voltage of at least about 0.25 volt.

7. (Original) The thermoelectric power source of claim 6 wherein the p-type or the n-type thermoelements are at least about 1 mm in length and at least about 0.1 mm in width.

8. (Original) The thermoelectric power source of claim 6 wherein the p-type or the n-type thermoelements are at least about 20 angstroms in thickness.

9. (Original) The thermoelectric power source of claim 1 further comprising at least about 1000 thermoelectric couples, wherein the thermoelectric power source has a power output of about 1 W with a voltage of at least about 1 volt.

10. (Previously presented) The thermoelectric power source of claim 1 wherein the p-type thermoelements each have a first width, the n-type thermoelements each have a second width, and the first width is different from the second width.

11. (Original) The thermoelectric power source of claim 1 wherein two or more p-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned p-type thermoelements are electrically connected in series to n-type thermoelements.

12. (Currently Amended) The thermoelectric power source of claim 1 wherein the thin film p-type thermoelement and/or the thin film n-type thermoelement are co-sputter deposited thin films comprising Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y wherein x is about 2 and y is about 3 ~~the flexible substrate is in a coil configuration~~.

13. (Original) The thermoelectric power source of claim 1 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W.

14. (Original) The thermoelectric power source of claim 1 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and provides voltages of greater than about 1 volt.

15. (Original) The thermoelectric power source of claim 14 wherein the thermoelectric power source produces power at temperature differences of about 20°C or less.

16. (Original) The thermoelectric power source of claim 1 wherein two or more n-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned n-type thermoelements are electrically connected in series to p-type thermoelements.

17. (Original) The thermoelectric power source of claim 1 wherein the n-type thermoelements are substantially free of selenium.

18. (Original) The thermoelectric power source of claim 1 wherein the flexible substrate is a polyimide.

Claims 19 – 22 (Canceled)

23. (Currently Amended) A thermoelectric power source comprising:

a flexible substrate having an upper surface;

multiple thermocouples electrically connected to one another on the upper surface of ~~the a~~ single flexible substrate, the thermocouples comprising:

sputter deposited thin film p-type thermoelements;

sputter deposited thin film n-type thermoelements alternatingly positioned adjacent the p-type thermoelements;

wherein the thermoelectric power source has a volume of less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W; and

wherein the p-type thermoelements or the n-type thermoelements comprise a Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y alloy where x is about 2 and y is about 3.

24. (Previously presented) The thermoelectric device of claim 23 wherein said multiple thermocouples electrically connected to one another are in series-parallel.

25. (Previously presented) The thermoelectric power source of claim 23 wherein the p-type thermoelements have L/A ratios greater than about 20 cm^{-1}.

Claims 26 – 36 (Canceled)

37. (Previously presented) A thermoelectric power source comprising:

a flexible substrate having an upper surface; and

a thermoelectric couple comprising:

(a) a sputter deposited thin film p-type thermoelement positioned on the upper surface of the flexible substrate;

(b) a sputter deposited thin film n-type thermoelement positioned on the upper surface of the flexible substrate adjacent the p-type thermoelement; and

(c) an electrically conductive member positioned on the flexible substrate, and electrically connecting the first end of the p-type thermoelement with the second end of the n-type thermoelement, wherein the p-type or the n-type thermoelements comprise Bi_xTe_y where x is about 2 and y is about 3; and

(d) wherein the flexible substrate is in a coil configuration.

38. (Previously presented) The thermoelectric power source of claim 37 wherein the p-type thermoelements or the n-type thermoelements are at least about 1 mm in length and at least about 0.1 mm in width.

39. (Previously presented) The thermoelectric power source of claim 37 wherein the volume of the thermoelectric power source is less than about 10 cm^3 and has a power output of from about 1 μW to about 1W.

Remarks

By entry of this Amendment, claims 1-3, 5-18, 23-25, and 37-39 are pending. Reconsideration is respectfully requested.

Claims 1, 5, 6, 13-15, 17-18 and 23 are rejected under 35 USC § 102(b) as allegedly being anticipated by DE 297 23 309 U1 (DE "309). Applicant traverses.

Amended claim 1 recites in part a thermoelectric power source comprising a flexible substrate having a plurality of thermoelectric couples formed thereon wherein the thermoelectric couples are formed on a single substrate and the flexible substrate is in a coil configuration or an accordion configuration.

Support for the amendment reciting the thermoelectric couples formed on a single flexible substrate and the flexible substrate is in a coil configuration or an accordion configuration, can be found in the present application at, e.g., p. 8, l. 27 – p. 9, l. 10 and Figs. 2a, 3, and 5-8.

DE '309 fails to teach or suggest such a power source as recited in amended claim 1. DE '309 teaches away from using a coiled or accordion configuration and requires multiple substrates to forms its power source. DE '309 only once refers to a flexible substrate and states that:

> In WO 89/00152, the thermocouples are deposited in a sinuous pattern on a film strip. The film strip is rolled up. **Rolling up with any given small bending radius is not possible**, however, since the strip cannot be sharply bent to any extent, because this will subject the thermoelectric layers to high mechanical loading, which produces a drastic increase in its electrical resistance and/or said layers are destroyed by micro cracks.

DE '309 English translation, Page 1, Para. 4.

Accordingly, DE '309 does not teach or suggest a flexible substrate, much less a flexible substrate formed in a coiled or accordion configuration. In fact, DE '309 specifically **teaches away** from rolling or bending a flexible substrate by stating that it would subject the thermoelectric layers to high mechanical loading which produces a drastic increase in its electrical resistance and/or the layers are destroyed by micro cracks. **Instead DE '309 discloses the use of, "[s]everal films . . . coated with thermocouples, contacts and metallized surface [that] are tightly stacked on top of each other and electrically connected with each other."** DE '309 English translation, Page 2, Para. 2. For at least these reasons, Applicant believes claim 1 is allowable over the art of record.

Amended claim 5 recites the thermoelectric power source of claim 1 wherein the thermoelectric power source has a power output of at least about 1 μW with a voltage of at least about 0.25 volt.

At no point does DE '309 teach or suggest a thermoelectric power source wherein the thermoelectric couples are formed on a single substrate and the flexible substrate is in a coil configuration or an accordion configuration and has a power output of at least about 1 μW with a voltage of at least about 0.25 V.

Instead DE '309 discloses the use of, "[s]everal films . . . coated with thermocouples, contacts and metallized surface [that] are tightly stacked on top of each other and electrically connected with each other." DE '309 English translation, Page 2, Para. 2. For at least these reasons, Applicant believes claim 5 is allowable over the art of record.

Claim 6 recites the thermoelectric power source of claim 1 further comprising at least about 50 thermoelectric couples, wherein the thermoelectric power source has a power output of at least about 1 μW with a voltage of at least about 0.25 volt. DE `309 does not teach or suggest such a power source. Rather, DE '309 describes a thermoelectric power source with several films "coated with thermocouples" and containing "approximately 100 films." (DE '309 English translation, Page 2, Para. 2) DE '309 further states: "At a 10 K temperature difference, a voltage of approximately 3 V and a power of roughly 10 μW can be achieved. . ." (DE '309 English translation, Page 2, Para. 4.) Thus, the described configuration of approximately 100 films that have a power output of roughly 10 μW and 3 V does not teach or suggest the thermoelectric power source as recited in claim 6. Claim 6 is also allowable over the art of record for the reasons set forth above in relation to claim 1.

Claims 13-15 and 17-18 are allowable for the reasons set forth above in relation to claim 1 and based on each claim's unique and non-obvious combination of features.

Amended claim 23 recites, in part, a power source formed on a single flexible substrate wherein the thermoelectric power source has a volume of less than about 10 cm^3 and has a power output of from about 1 μW to about 1 W. Claim 23 is allowable for the reasons set forth above in relation to claim 1 and claim 5.

Accordingly, Applicant respectfully requests that the rejection of claims 1, 5, 6, 13-15, 17-18 and 23 based on DE '309 be withdrawn.

Claims 1-3, 5, 10 and 18 are rejected under 35 USC § 102(e) as allegedly being anticipated by Stark (USPG Pub 2004/0231714). Applicant traverses.

The Examiner asserts that the evidence submitted with the November 29, 2007 filed § 1.131 Declaration was insufficient to establish reduction to practice of certain elements recited in claims 1, 23, and 37. While Applicant disagrees, a substitute § 1.131 Declaration has been filed herewith.

Although Applicant disagrees that the Stark publication anticipates or makes obvious the subject claims, submitted herewith is a Declaration Under § 1.131 documenting that the inventors conceived and reduced their invention to practice in the United States prior to the effective date (May 19, 2003) of the Stark publication. Thus, the Stark publication is not available as prior art, and the rejection is now moot.

Claims 23-25 are rejected under 35 USC § 103(a) as allegedly being obvious in view of Stark (2004/0231714). Applicant traverses.

As discussed above, although Applicant disagrees that Stark anticipates or makes obvious the subject claims, the Stark publication is no longer available as prior art, and thus these rejections are moot.

Claims 6-9, 11 and 13-16 are rejected under 35 USC § 103(a) as allegedly being obvious in view of Stark as applied to claims 1-5, 10 and 18 above. Applicant traverses.

As discussed above, although Applicant disagrees that Stark anticipates or makes obvious the subject claims, the Stark publication is no longer available as prior art, and thus these rejections are moot.

Claims 11 and 16: It is notable, however, that claim 11 recites the thermoelectric power source of claim 1 wherein two or more p-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned p-type thermoelements are electrically connected in series to n-type thermoelements and claim 16 recites the thermoelectric power source of claim 1 wherein two or more n-type thermoelements are positioned and electrically connected in parallel with one another and the parallel positioned n-type thermoelements are electrically connected in series to p-type thermoelements. None of the art of record, including Stark, even mention, let alone teach or

suggest such a thermoelement arrangement. Accordingly, these claims are allowable over the art of record whether or not Stark remains a citable reference.

Claims 12, 17 and 37-39 are rejected under 35 USC § 103(a) as allegedly being obvious in view of Stark as applied to claims 1-5, 10 and 18 above, and further in view of Barr (US 4,036,665). Applicant traverses.

As discussed above, although Applicant disagrees that Stark anticipates or makes obvious the subject claims, the Stark publication is no longer available as prior art and these rejections are moot with respect to the Stark publication.

Claim 12

Amended claim 12 recites the thermoelectric power source of claim 1 wherein the thin film p-type thermoelement and/or the thin film n-type thermoelement are co-sputter deposited thin films comprising Bi_xTe_y, Sb_xTe_y, or Bi_xSe_y wherein x is about 2 and y is about 3. Neither DE'309 nor Barr teaches, suggests, nor enables, nor does the Examiner contend that these references teach, suggest, or enable the particular co-sputter deposited bismuth telluride alloys forming p-type or n-type thermoelements as recited in claim 12.

Support for this claim amendment can be found throughout the specification, e.g., at p. 12, ll. 28-30; Fig. 11; Examples 1 and 2.

At no point does Barr, DE`309 or any of the art of record even mention the use of such co-sputter deposited compounds as thermoelements as recited in claim 12.

Barr and DE`309 both fail to enable one of ordinary skill in the art as to how to make a co-sputter deposited alloy species as recited. As discussed above, a prior art reference must be enabling for an Examiner to rely on the reference as a prior art rejection. (MPEP § 2131.01(a).) Because extensive experimentation was required both to choose as suitable and how to make the claimed co-

sputter deposited bismuth telluride alloys, DE'309 and Barr do not enable the claimed alloys and thus do not render claim 12 unpatentable.

Respectfully submitted,

KLARQUIST SPARKMAN, LLP

By _____

Lisa M. Caldwell
Registration No. 41,653

One World Trade Center, Suite 1600
121 S.W. Salmon Street
Portland, Oregon 97204
Telephone: (503) 595-5300
Facsimile: (503) 595-5301